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GEOLOGY.—*On the origin of the "rock wall" at Rockwall, Texas.*[1]

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There is in Texas, about 20 miles northeast of Dallas, a town by the name of Rockwall, the county seat of Rockwall County. The town derives its name from a natural feature which is locally called the "rock wall." Mr. Sidney Paige[2] investigated the "rock wall" in 1909, and the following paragraphs are quoted from his account of it:

> For many years reports of a more or less definite nature have been circulated describing the wonders of the ancient wall surrounding the town of Rockwall, Texas. The writer was able during the past winter to spend a few days investigating this supposed historic structure. It proves to be not a wall, but a number of disconnected sandstone dikes, strictly speaking, not surrounding the town, but trending in many directions. As exposures are few, they have been discovered in such scattered localities in the town's environs as to suggest the idea that they were fragments of a ruined wall.
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> Though good exposures are infrequent, owing to the depth of the soil, a peculiar condition affords ample opportunity to observe the dikes in place. These latter are natural courses for underground waters, and wells are often located on them. Though these wells are filled with water, the rock forming the dike, removed during the sinking of the well, may be examined at leisure.

I have recently had an opportunity to examine one of the so-called rock walls at a locality at the west edge of the town at a point where it intersects the Dallas-Greenville road. The town is located at the crest of the west-facing slope of the valley of the East Fork of Trinity River (sometimes called Bois d'Arc Creek), south of the valley of

[1] Published by permission of the Director, U. S. Geological Survey, Washington, D. C. Received November 30, 1926.

[2] PAIGE, SIDNEY, *The "rock wall" of Rockwall, Texas.* Science n. ser. **13**: 690–691. 1909.

Squabble Creek. The wall where I saw it intersects the road about a quarter of a mile west of the center of the town, at an altitude 45 or 50 feet lower than the top of the hill. The owner of the land at this place has made several excavations along the side of the wall, which here trends several degrees west of north, and an appropriate sign at the side of the road invites the interested traveller to view the ancient archaeological structure, which he is permitted to do after the payment of a small entrance fee.

Paige's interpretation, that the wall is not an artificial structure but is in the nature of a sandstone dike, is doubtless correct, but his explanation of the cause of its wall-like appearance needs modification. He says:

> The dikes are of various sizes, varying from an inch in thickness to eighteen inches or two feet. They stand vertically, or nearly so, and have in cases been followed downward fifty feet or more, always imbedded in the lime muds. They are composed of exceedingly fine-grained quartz sands, cemented by calcium carbonate. So far as observed they do not vary appreciably in width through vertical range. Two joint systems, one nearly horizontal, the other vertical, have cut these dikes in such a manner as to suggest masonry walls, i.e., they are composed of oblong blocks in horizontal layers.

The "wall" which I saw is not a solid sandstone dike broken by horizontal joints, but is composed of a series of alternating, more or less lens-like horizontal layers of clay and sandstone. The clay layers reach a maximum of an inch or more in thickness, and the sandstone layers may attain a thickness of as much as 6 or 8 inches. The sandstone beds are cut by vertical joints perpendicular to the face of the wall. Some of the sandstone layers thin down and pinch out in a lens-like manner, and some of them divide into two layers separated by clay. The combination of horizontal bedding and vertical jointing in the sandstone layers, gives to the dike its masonry-like appearance. The relatively thin clay layers simulate the mortar of an artificial wall. The vertical joints are irregularly distributed and do not occur in the form of "broken joints," as would be expected in a true masonry wall. Two views of the dike are shown in plate 1.

Paige did not reach a definite conclusion as to the origin of the dikes. He states that the fissures may have been due to drying or to earth movements, and that the material filling them may have come from below or from above. The fissures are too deep, I think, to have been formed by desiccation from the surface downward. Earth movements that produced and widened joints into fissures seem adequate to account for them. Since the dikes are horizontally stratified the

materials must have been washed in from above and were probably deposited in standing water in the fissures. The fissures must have

A. View of one of the sandstone dikes or rock walls in an excavation on the east or up-slope side, at the west edge of Rockwall town; the dike has here been disturbed by soil creep which has tipped it over, least below, most above, widening the spaces between the hard sandstone layers.

B. View of the same dike in an excavation on the down-slope side where the clay and sand layers are in undisturbed relation to each other, showing the lenslike character of the sandstone layers; the argillaceous chalk or chalky marl which is cut by the dike is shown on the left.

remained open during the time they were being filled with clay and sand. If the fissures were opened on a land surface, and were filled by

sediments carried by surface water, one would expect strong cross bedding in the dikes with some coarse foreset beds similar to the bedding found in delta deposits, and he would expect the sediments to be mixed with oxidized substances, leaves, seeds, sticks, bones, and other surficial materials. Instead the sediments are clean and uniform with the exception of the scattered fragments of gray unoxidized clay, and I am therefore inclined to the opinion that the fissures were formed under water, probably that of a shallow sea during the latter part of Upper Cretaceous time.

The dike at the west edge of Rockwall cuts the Pecan Gap tongue of the Annona chalk, of Upper Cretaceous age, which here consists of argillaceous chalk or chalky marl, nearly free from sand. Two or 3 feet below the surface the chalk is practically fresh, showing only slight signs of weathering and oxidation. The chalk forms the upper part of the west-facing slope of the hill and the only source of sand that seems adequate to furnish the sandy material of the dike is the Wolfe City sand member of the Taylor marl, which in the next county to the north lies stratigraphically beneath the chalk. I have not seen the Wolfe City sand in the immediate vicinity of Rockwall, but it probably underlies the chalk there. Paige mentions "thinly bedded flaggy sandy limestone" near Rockwall, but does not give the exact locality. The beds of the Pecan Gap chalk at this locality dip at a low angle toward the east, so that the Wolfe City sand, if present, may have come to the surface within a few miles to the west, where it was subject to erosion at the time the dikes were formed in late Cretaceous time.

The sandstone layers consist of medium-grained gray calcareous sand cemented with calcite. Scattered through the sand composing the sandstone layers are considerable numbers of mechanically included clay fragments, the largest noted being about three-fourths of an inch long.

Mr. C. S. Ross has examined thin sections made from one of the sandstone layers and he describes it as follows:

> The sand grains are predominantly quartz, but there are many grains of feldspar and chert, and a very few of muscovite. Most of the grains are sharply angular but some are subangular. A few are well rounded or have one border that is well rounded and the other angular, as if rounded grains had been fractured. The calcite cement has replaced or corroded some of the sand grains and especially the feldspar. A veinlet of calcite cuts one of the sections.

Mr. Ross also examined a thin section made from a sample of the Wolfe City sand from near Wolfe City, about 40 miles northeast of Rockwall, and he says of it:

> The mineral grains are predominantly quartz, but smaller amounts of feldspar, mica, and other minerals, are present. The grains are sharply angular for the most part. The cementing material is finely granular calcite. The sand grains average about 0.05 mm. in diameter.
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> Compared with the material from the dike this sample of Wolfe City sand is quite similar in type and angularity of the sand grains, and the inclosing calcite is somewhat similar in habit. The sand grains differ greatly in size, however, since those in the dike average about 0.2 mm., while those in the Wolfe City specimen are only 0.05 mm. in diameter.

So far as the evidence goes, therefore, the sand composing the dikes might well have been derived from the Wolfe City sand, but the samples compared are geographically too far apart to warrant basing a final conclusion upon them.

PALEONTOLOGY.—*On the type skull of* Equus laurentius *Hay.*[1]

OLIVER P. HAY, U. S. National Museum.

In 1913[2] the writer described as belonging to a new species of *Equus* (*E. laurentius*) a nearly complete skull which had been found on a sandbar of Kansas River, near Lawrence, Kansas. Prof. J. E. Todd told the writer that with this skull were picked up the base of an antler of an elk and the femur of a carnivore. The femur was regarded by Dr. Roy E. Moodie as belonging probably to a species of *Smilodon*.

In an excellent paper published recently[3] entitled "The evolution of the horse: A record and its interpretation," Dr. W. D. Matthew, of the American Museum of Natural History, on his page 181, mentioned, with other species, *Equus laurentius* and added as follows: "The last is based upon a recent skull mistakenly supposed by the author to be of Pleistocene age." No reasons were given for this statement. On reading this the writer became anxious to see that skull once more and to determine for himself whether or not he had fallen into error. The skull is now in the temporary possession of Dr. Childs Frick, of the American Museum, New York, and on the writer's request Dr. Frick generously sent the specimen.

It appears to the writer that two questions are involved. First,

[1] Received Nov. 2, 1926.

[2] Proc. U. S. Nat. Mus. **44**: 584–591. *Pl. 72, 73.* 1913.

[3] Quart. Rev. Biol. **1**: 139–185. 1926.

is the skull of Recent or of Pleistocene age? Second, is it specifically identical with any of the breeds of the domestic horse, *Equus caballus?*

In case the skull is that of a modern horse it must have been buried within 300 years or less; also very near the place of discovery, for, excepting the loss of the free portions of the nasal bones, it shows no abrasions. Furthermore, the lower jaw was found with the skull. Without doubt it had been buried in a river deposit, either of sand or possibly of sandy muck. Under such conditions one would expect a modern skull to be little or not at all mineralized, to be soft and friable, and to be of relatively light weight on drying out. Often bones of elephants, mastodons, and horses, which have been in such deposits since the early Pleistocene are so soft that they must be handled with the greatest care to prevent crumbling.

Now, the skull found at Lawrence is in no such condition. The specimen, skull and lower jaw, is heavy, charged and colored with iron carbonate, and hard. When an area of the skull has been covered many hours with a pad of wet paper the bone does not soften, as it might be expected to do. It seems to the writer that the conditions for fossilization must have been extraordinarily favorable in order that a skull might, within 300 years, reach such a stage of preservation.

Does the type of *E. laurentius* present characters which distinguish it from *Equus caballus?* The skull is that of one of the smaller horses, the basilar length being 490 mm. (not 481). It has been spoken of as an "Indian pony." It ought to be compared with the smaller breeds of the domestic horse. Unfortunately there is, in the U. S. National Museum, no good specimen of the small horses from the western plains, and probably there is none in the American Museum. At hand is a skull obtained in Arizona by Dr. Walter Hough, of the U. S. National Museum. It is weathered and somewhat damaged.

The writer has taken renewed measurements of the skull from Lawrence and measurements of the Arizona skull. From these measurements have been determined the indices of the important parts according to Prof. H. F. Osborn's method;[4] and the corresponding indices have been compared. They have also been compared with indices obtained from the skulls of *Equus lambei* from Alaska, *Equus niobrarensis*, and *Equus przewalskii*. All of these forms show differences in the structure of their skulls, but these differences are small and apparently might fall within individual variations. The writer believes that no one would, without other characters, base a species on

[4] Mem. Amer. Mus. Nat. Hist. new ser. 1: 85. 1912.

such closely similar indices; nor would one, because of these resemblances, refer all of these horses to one species. We seem still compelled to depend on the structure of the teeth and on variations in size of the animals.

The upper cheek teeth are present in the Arizona horse, but they are somewhat shattered, and the second premolars are missing from their sockets. The teeth of the two horses are in about the same stage of wear. The tooth line measures the same in both and the individual teeth are of practically the same size in the two. In both horses the protocones are short. The postprotoconal valleys appear to differ in that those of the Arizona horse are directed more strongly outward than in *E. laurentius*. The fossettes of the latter are markedly broader than those of the Arizona horse, and the enamel which surrounds the fossettes is little folded. The hinder one has a very shallow infold in the rear and another in front. Except this, the front wall of the hinder fossette has no undulations. The front wall of the anterior fossette may or may not have a shallow infold; in its inner hinder corner is an M-shaped infold. In the case of the fossettes of *E. laurentius* the confronting lines of enamel are considerably more folded than in the Arizona horse and the complication somewhat exceeds that of a large domestic horse at hand.

The writer believes that the type skull of *Equus laurentius* is a real fossil and that it belonged to a horse of probably early Pleistocene age. It appears only fair that those who regard it as a part of a modern horse shall present evidences therefor.

BOTANY.—*New plants from Central America.—VI.*[1] PAUL C. STANDLEY, U. S. National Museum.

The new species of plants, chiefly trees and shrubs, described here are all natives of Panama or Costa Rica, and most of them have been collected by myself during the past two years. The Panama species are probably the only new ones awaiting description from the region of the Canal Zone previous to the publication of a flora of that area.

Most interesting of the new plants described is *Parmentiera Valerii*, a large tree belonging to a group hitherto represented in Central America by only two known species, both of which are trees much inferior in size to this one.

[1] Published by permission of the Secretary of the Smithsonian Institution. For the last preceding paper of this series see THIS JOURNAL 15: 472. 1925. Received Nov. 2, 1926.

Lacistema pedicellatum Standl., sp. nov.

Shrub or tree 2–7.5 meters high, the branchlets slender, terete, when young densely strigillose; stipules lance-triangular, 1.5–2 mm. long; petioles slender, 3–8 mm. long, strigillose; leaf blades elliptic-oblong or obovate-oblong, 8–11.5 cm. long, 2.5–4 cm. wide, cuspidate-acuminate, with acute or obtuse tip, cuneate to obtuse at base, membranaceous, remotely and obscurely serrulate, green and glabrous above, paler beneath, sparsely and minutely strigillose, densely pilose along the costa and in the axils of the lateral nerves; racemes solitary in the leaf axils, 3.5–6.5 cm. long, slender, laxly flowered, the rachis densely sordid-hispidulous, the bracts puberulous, much shorter than the pedicels, the pedicels 1–2 mm. long, glabrous; sepals 3 or 4, broadly rounded, glabrous; disk large, 4-lobate; stamen glabrous, the cells divergent; ovary very sparsely setose, the style short, the stigmas 3, longer than the stamen; fruit subglobose, 4 mm. in diameter, sparsely puberulent; seeds 3.

Type in the U. S. National Herbarium, no. 679251, collected along the Río Culebra above Santa Isabel, Province of Colón, Panama, near sea level, Aug. 10, 1911, by H. Pittier (no. 4152). Collected also on hills north of Frijoles, Canal Zone, Dec. 19, 1923, *Standley* 27426.

The most closely related species is *L. Pittieri* Blake, of Venezuela. Both are marked by the pedicellate flowers, those of most species being sessile in the bracts. *L. Pittieri* differs from the Panama plant in its densely hispid ovary and entire leaves.

Heisteria longipes Standl., sp. nov.

Glabrous shrub, the branchlets slender, green; petioles slender, 7–12 mm. long; leaf blades elliptic to elliptic-oblong, 8–12 cm. long, 3–6 cm. wide, abruptly obtuse-acuminate or obtuse, acute at base, thin, the lateral nerves 7 to 9 on each side, slender; pedicels in fascicles of 2 or 3, slender, 1–1.5 cm. long; fruiting calyx rotate, purplish red, 2 cm. broad, subentire; petals 6, ovate-deltoid, acute; stamens 12, slightly longer than the petals; fruit oval, 8 mm. long.

Type in the U. S. National Herbarium, no. 679090, collected along the Trinidad River, Canal Zone, Panama, July, 1911, by H. Pittier (no. 4006).

The leaves are much like those of *H. macrophylla* Oerst., the most widely distributed species of Central America, but in that the pedicels are shorter than, or rarely equal, the fruiting calyx.

Heisteria latifolia Standl., sp. nov.

Small tree, 4 meters high, glabrous, the branchlets obtusely angulate, green; petioles thick, stout, about 2 cm. long; leaf blades elliptic or broadly elliptic, 27–32 cm. long, 12–15 cm. wide, acuminate, rounded or obtuse at base, subcoriaceous, lustrous above, the lateral nerves about 16 pairs, subarcuate, anastomosing near the margin; pedicels usually geminate, 1 cm. long; fruiting calyx subentire, rotate, red, 2–2.5 cm. broad; fruit oval, 12 mm. long.

Type in the U. S. National Herbarium, no. 679256, collected along the Río Culebra above Santa Isabel, Province of Colón, Panama, near sea level, Aug. 10, 1911, by H. Pittier (no. 4156).

Distinguished from all the other Central American species of the genus by the very large, broad leaves, borne on comparatively long petioles.

Hydrangea inornata Standl., sp. nov.

Scandent shrub, the branchlets terete, covered with brown, longitudinally sulcatulate bark, when young tomentulose, the internodes elongate; petioles 1–2 cm. long, glabrous; leaf blades elliptic or oblong-elliptic, 8–23 cm. long, 3.5–11 cm. wide, acutely acuminate or abruptly contracted into a short acumen, acute or subobtuse at base, coriaceous, entire, glabrous on both surfaces, the lateral nerves 5 to 8 on each side, arcuate, prominent beneath, the ultimate nerves closely reticulate, prominulous beneath; inflorescences ample, short-pedunculate, 5–9 cm. broad, the cymes umbellately arranged, many-flowered, the rachises stellate-tomentulose, the axes of the first order 1–3 cm. long, equaling or surpassing the rest of the cyme, the pedicels 1–4 mm. long or the flowers sessile; flowers all fertile, pink; sepals 4, much broader than high; petals 4, 2 mm. long; stamens 8, the filaments 1.5 mm. long, the anthers small; styles 3 or 4; hypanthium broadly cup-shaped, glabrous, 1.5 mm. wide.

Type in the U. S. National Herbarium, no. 577962, collected in forests at Tuis, Atlantic slope of Costa Rica, altitude 700 meters, December, 1900, by H. Pittier (no. 14068).

This Costa Rican plant appears to be related to *H. ecuadorensis* Briq., and belongs to the Section *Cornidia*, Subsection *Monosegia* B. *Aphananthae*, as outlined by Briquet.[2]

Aside from the Panama species here described, only one other *Hydrangea* is known from Central America, *H. Oerstedii* Briq., which is frequent in the higher mountains of Costa Rica. It is a large woody vine with broad cymes which bear numerous bright pink sterile flowers. It is a very handsome plant when in full flower, and quite as showy as the cultivated hydrangeas.

The juvenile plants of *H. Oerstedii* are very different in general appearance from the adult ones. They are very slender, with coarsely toothed leaves only 1 to 3 cm. long. These juvenile plants are abundant nearly everywhere in the mountains of Costa Rica, closely investing tree trunks and even fence posts. The writer for several years has been familiar with this form, and had often wondered to what family it might belong. It was only during the past winter, after close study, that the true relationship of this juvenile form was recognized, and even then it was hard to credit the evidence, so different in aspect are the two states of the plant. The juvenile plants are many times more plentiful than adult ones.

In 1922 I collected in Salvador on the Volcano of San Salvador juvenile plants of this genus, but at that time did not recognize their relationship. The Salvador plant may be the immature form of *H. Oerstedii*, or perhaps it belongs to a species not yet described.

[2] Ann. Cons. Jard. Bot. Genève **20**: 396. 1919.

Hydrangea panamensis Standl., sp. nov.

Shrub, the branchlets terete, brown, when young appressed-stellate-tomentose, the internodes short; petioles stout, 1–1.5 cm. long, stellate-tomentose; leaf blades oblong, elliptic, or ovate, 8–10.5 cm. long, 3–4.5 cm. wide, obtuse at apex or rounded and emarginate, obtuse at base, coriaceous, entire, above dark green, furnished with remote microscopic appressed stellate scalelike hairs, beneath brownish, sparsely and microscopically stellate-pilose, the lateral nerves about 6 on each side, straight, laxly anastomosing close to the margin, prominent beneath, the reticulation of the ultimate nerves inconspicuous; inflorescences dense, pedunculate, 3.5 cm. broad; bracts caducous, 1.5–2 cm. long, rounded at apex, stellate-tomentose on the outer surface; axes of the first order umbellately arranged, about 1 cm. long, densely brown-tomentose, about as long as the upper part of the cyme; flowers sessile or short-pedicellate; sepals 4, broadly triangular, obtuse, broader than long; petals 4, rounded, 2 mm. long, glabrous; stamens 8; styles 3 or 4; hypanthium campanulate, glabrous, rounded at base, 1.5 mm. wide.

Type in the U. S. National Herbarium, no. 678998, collected along the Río Fató, Province of Colón, Panama, near sea level, July, 1911, by H. Pittier (no. 3919).

The collector reports that the plant was epiphytic upon a *Sloanea* tree. The corolla is described as yellow, and the bracts and calyx as purple.

This *Hydrangea* is noteworthy in its habitat, since most of the tropical American species occur only in the high mountains. The Panama species belongs to the same group as *H. inornata*, and in Briquet's key to the species would run to *H. Mathewsii* Briq., a Peruvian plant with rugose-nerved, obovate, crenate-denticulate leaves.

To *H. panamensis* are to be referred, probably, juvenile specimens collected by the writer (no. 27431) near Frijoles, Canal Zone, in 1923.

Erythrina panamensis Standl., sp. nov.

Shrub or tree 1–6 meters high, the young branchlets whitish-sericeous; branches armed with stout conic prickles; petiole and rachis at first sericeous but soon glabrate, the petiole sometimes prickly; leaflets deltoid to ovate-deltoid, the terminal leaflet often rounded-deltoid, 11–24 cm. long, 6.5–18.5 cm. wide, abruptly or gradually acuminate or long-acuminate, entire, thin, above bright green and glabrous or glabrate, beneath pale, sericeous with slender straight whitish hairs; racemes about 12 cm. long, the rachis tomentulose, the pedicels 2–4 mm. long; calyx 14–17 mm. long, tubular-campanulate, 5–6 mm. thick, minutely strigillose with whitish hairs or almost wholly glabrous, the margin shallowly bilobate, the lobes subequal, rounded; standard red, glabrous, linear-oblong, obtuse, about 6 cm. long, 1 cm. broad, attenuate at base; keel petals cohering above, 11–12 mm. long; pod long-stipitate, 11–20 cm. long, about 1.5 cm. thick, 4 to 13-seeded, strongly and abruptly constricted between the seeds, at first densely whitish-sericeous, later glabrate; seeds red, about 9 mm. long, 6 mm. thick.

Type in the U. S. National Herbarium, no. 677253, collected about the Agua Clara Reservoir near Gatún, Canal Zone, Panama, February 5, 1911, by H. Pittier (no. 2656).

The following Panama collections represent the same species: Río Indio de Gatún, Canal Zone, *Maxon* 4808. Near Gatún, *Goldman* 1854. Barro Colorado Island, Canal Zone, *Standley* 31352. Cana, *Williams* 782. Between Gorgona and Gatún, *Pittier* 2287.

The writer previously[3] referred most of this material to *E. costaricensis* Micheli, but more ample Costa Rican material of that species proves that the Panama *Erythrina* is distinct. *E. costaricensis* may be distinguished readily by the loose matted tomentum of the leaves.

DYSOPSIS GLECHOMOIDES (Rich.) Muell. Arg.

It seems worth while to record here the occurrence in Costa Rica of *Dysopsis*, a monotypic genus of the family *Euphorbiaceae*, not reported previously north of the Andes of Ecuador. Specimens were collected by Prof. Juvenal Valerio and the writer (no. 43770), Dec. 31, 1925, on the Cerro de las Vueltas, Province of San José, Costa Rica, at an altitude of 3,000 meters. The plant is an inconspicuous succulent herb, growing in wet forest. Various writers have stated that in general appearance it resembles *Hydrocotyle*, but when growing it scarcely suggests that genus, although it does have a striking resemblance to certain species of *Pilea*.

Euphorbia Valerii Standl., sp. nov.

Slender shrub 3–4.5 meters high, sparsely branched, glabrous throughout the branches about 1 cm. thick at apex and bearing there a few leaves, densely covered with the scars of the fallen leaves; leaves alternate, the petioles stout 1.5–2.5 cm. long; leaf blades narrowly oblanceolate-oblong, 35–40 cm. long 9–10 cm. wide, entire, obtuse, gradually narrowed from near the apex to the acute base, abruptly decurrent upon the petiole, the lateral nerves obsolete; peduncles arising in the axils of the uppermost leaves, stout, 18–24 cm. long; flowers numerous, the pedicels 1–1.5 cm. long, arranged in 3 or 4 times dichotomous cymes 7 cm. long and 9 cm. broad; bracts of the inflorescence caducous, not seen; involucre broadly campanulate, reddish, about 7 mm. long, 10 mm. wide, the lobes ovate-quadrate, their margins laciniate; styles united almost to the apex; immature capsules subglobose, more than 1 cm. in diameter.

Type in the U. S. National Herbarium, no. 1,251,433, collected in wet forest at Los Ayotes, in the Sierra de Tilarán, Guanacaste, Costa Rica, altitude about 700 meters, Jan. 21, 1926, by Paul C. Standley and Juvenal Valerio (no. 45338).

Euphorbia Valerii is referable to Boissier's group *Laurifolia*, which has been recognized by some botanists as a separate genus, *Euphorbiodendron*. No species of this group has been reported from Central America. *Euphorbia Sinclairiana* Benth., described from Gorgona Island, Colombia, is, to judge from its description, closely related to the Costa Rican plant, and it may be that the two are conspecific. The involucres in *E. Sinclairiana* are described as smaller, and the leaves as acutely short-acuminate.

[3] Contr. U. S. Nat. Herb. **20**: 180. 1919.

Only two or three plants of *E. Valerii* were found, growing in very dense and wet forest. The branches, when broken, yield a copious flow of white latex. The sap of the related species of Mexico is known to cause blistering and painful inflammation of the skin.

Loasa grandis Standl., sp. nov.

Coarse herb 1.5–2.5 meters high, branched only above, the branches stout, hollow, hispid with slender divaricate stinging hairs, and covered with dense, very short hairs hooked at apex; leaves alternate, the petioles 4.5–7 cm. long, pubescent like the stems; leaf blades in outline elliptic or ovate-elliptic, 16–30 cm. long, 12–24 cm. wide, the uppermost much reduced, acute or acuminate, at base rounded to shallowly cordate, shallowly lobed, the lobes 4 or 5 on each side, broadly triangular, obtuse or acute, irregularly dentate; leaves thin, above along the nerves short-hispid, scabrous, beneath hispid along the costa, furnished along the nerves with slender nail-shaped hairs, elsewhere scaberulous; flowers numerous, arranged in a large much-branched panicle bearing a few reduced leaves, the pedicels 2–3 cm. long; sepals broadly ovate, about 1 cm. long, acute, 5 or 7-nerved, sparsely serrate-dentate, scabrous; petals pale green, cucullate, almost orbicular, about 3 cm. long, rounded at apex, furnished on both sides with minute nail-shaped hairs; scales oval, petaloid, 7 mm. long, 4 mm. wide, broadly rounded at apex, glabrous, bearing outside below the apex 3 small conic appendages; staminodia 2 opposite each scale, linear-attenuate, about equaling the filaments, ciliate at the middle; stamens numerous, the filaments free, glabrous, inserted continuously between the staminodia, 1 cm. long; anthers oblong, almost 2 mm. long; ovary 1-celled, densely hispid, with 5 parietal placentae, the ovules numerous; style columnar, about 12 mm. long, the stigma obtuse; immature capsule more than half superior, the free portion hispid with very slender, short hairs.

Type in the U. S. National Herbarium, no. 1,251,425, collected in wet forest near Tilarán, on the road to El Silencio, in the Cordillera de Tilarán, Guanacaste, Costa Rica, altitude about 625 meters, in January, 1926, by Paul C. Standley and Juvenal Valerio (no. 44558).

The plant seems to be rare, since it was seen only once in the several weeks spent in exploration of the Cordillera of Tilarán. The large flowers are rather handsome.

This has little in common with the two other species of *Loasa* known from Costa Rica. Of the latter, *L. speciosa* Donn. Smith is known only from the volcanoes of Irazú and Turrialba and the adjacent slopes. Its orange-yellow bell-shaped flowers are about 6 cm. long, and very showy, but they are well protected, since the long hairs, as in other species of the genus, sting quite as painfully as any nettle. On Irazú this species is known as "campana" and at Las Nubes it is called "ortiga veinticuatro." The latter name is given because the pain from the sting is said to last 24 hours.

The other Central American species has been described as *Loasa bipinnata* Donn. Smith, but it appears to be only one of the forms of *L. triphylla* Juss., which is widely distributed in South America. Above the Isthmus of

Panama it is known from Chiriquí in Panama and from Costa Rica and Veracruz. In many parts of Costa Rica it is an abundant and pernicious weed of the forests. Many are the anguished exclamations I have heard from companions on botanical excursions who have brushed against the plant, for the stiff hairs penetrate ordinary clothing with the greatest ease. In Costa Rica this plant often is called "ortiga" (nettle), but the more usual name is "pringamosca," evidently a corruption of the term "pringamoza," which is given elsewhere in Mexico and Central America to various stinging plants.

Ardisia myriodonta Standl., sp. nov.

Plant woody or suffrutescent, 0.3–1 meter high, the branchlets terete, stout, glabrous, toward the apex minutely brown-punctate; petioles slender, 8–16 mm. long, glabrous; leaf blades oblong-elliptic, 12–25 cm. long, 4.5–9.5 cm. wide, subabruptly short-acuminate, long-attenuate toward the base, thinly membranaceous, glabrous, along the margin densely red-punctate, the lateral nerves about 18 on each side, subarcuate, prominent beneath, the margin pectinate-serrate, the teeth very numerous, close-set, very narrow, attenuate, unequal; inflorescence small, sessile, 3.5 cm. long, many-flowered, dense, tripinnately paniculate, the flowers subcorymbose, the pedicels 3–5 mm. long, glandular-lepidote, the bracts deciduous; sepals 5, nearly free, lance-oblong, attenuate, 2 mm. long, densely punctate, very minutely ciliolate-dentate; fruit globose, black, 6 mm. in diameter, glabrous, sparsely verruculose-punctate.

Type in the U. S. National Herbarium, no. 1,251,625, collected on Barro Colorado Island in Gatún Lake, Canal Zone, Panama, November, 1925, by Paul C. Standley (no. 40848). No. 40841 from the same locality also represents the species.

Related, according to description, to *A. pellucida* Oerst., of Mexico and Guatemala, which has longer petioles and broadly ovate sepals. Flowers of the Panama plant are, unfortunately, not available. It is remarkable for its low stature, most of the Central American Ardisias being large shrubs or small trees.

Vincetoxicum pinguifolium Standl., sp. nov.

Large scandent herb, the branchlets terete, densely covered with minute divaricate hairs and sparsely divaricate-hirsute with hairs about 2 mm. long; petioles slender, 2–4 cm. long; leaf blades rounded-ovate, 5.5–9.5 cm. long, 3–7 cm. wide, abruptly short-acuminate, deeply cordate at base, the sinus narrow, the basal lobes broadly rounded, the blade multiglandular at base, green above, paler beneath, on both sides soft-pubescent with very minute, dense hairs, the lateral nerves about 5 on each side, prominent beneath; inflorescences umbelliform, few-flowered, the peduncle 6–16 mm. long, the pedicels 10–25 mm. long, minutely pubescent, the bractlets subulate, 2–3 mm. long; calyx lobes lance-ovate, acute, 3 mm. long, minutely pubescent outside; corolla reddish brown, minutely puberulent outside, within pilose with few long white hairs, deeply lobate, the lobes 6 mm. long, ovate, obtuse; corona shorter than the gynostegium, annular, fleshy, black, irregularly corrugate; immature follicles long-tuberculate, densely hirsute.

Type in the U. S. National Herbarium, no. 1,251,722, collected in wet forest on Barro Colorado Island in Gatún Lake, Canal Zone, Panama, November, 1925, by Paul C. Standley (no. 40946). Nos. 40871 and 41116, from the same locality, represent the same species.

In this large genus, whose species are so badly in need of critical revision, it is difficult to suggest the relationship of the plant here described. It has not been possible to refer it to any of the few species reported previously from Central America.

The extremely fine and dense pubescence of the leaves makes them feel soft and greasy to the touch.

Vincetoxicum edule (Hemsl.) Standl.

Gonolobus edulis Hemsl. Biol. Centr. Amer. Bot. **2:** 331. 1882.

Vincetoxicum pseudobarbatum (Pittier) Standl.

Gonolobus pseudobarbatus Pittier, Contr. U. S. Nat. Herb. **13:** 105. *f. 14.* 1910.

Vincetoxicum dubium (Pittier) Standl.

Gonolobus dubius Pittier, Contr. U. S. Nat. Herb. **13:** 106. *f. 15.* 1910.

Vincetoxicum viridiflorum (Mey.) Standl.

Cynanchum viridiflorum Mey. Prim. Fl. Esseq. 141. 1818.
Gonolobus viridiflorus Roem. & Schult. Syst. Veg. **6:** 61. 1820.

Lycianthes Maxonii Standl., sp. nov.

Slender branched erect shrub 1–3 meters high; branchlets at first minutely pilose with incurved lustrous hairs, later subterete, glabrous; leaves solitary, subequal, the petioles 4–6 mm. long; leaf blades oblong-obovate to cuneate-obovate, 9–13 cm. long, 3–5 cm. wide, abruptly short- or long-acuminate (acumen short and obtuse or 15 mm. long and attenuate), cuneate or obtuse at base, thin, at first minutely punctulate, in age glabrous, above deep green, paler beneath; inflorescences sessile in the leaf axils, 1 to 3-flowered, the pedicels slender, 6–22 mm. long, glabrous, divaricate or recurved; calyx cup-shaped, 2.5 mm. long, 3 mm. broad, glabrous, whitish, bearing near the truncate subscarious margin (about 1 mm. below the margin) 5 very short, wartlike, greenish tubercles; corolla violet, stelliform, 5 mm. long, glabrous outside, deeply lobed, the lobes linear-oblong, acute; filaments equal, 1.5 mm. long, glabrous, the anthers oblong, 3.5 mm. long, connate, obtuse, dehiscent by minute apical pores; fruit subglobose, bright red, about 1 cm. in diameter, 4-seeded.

Type in the U. S. National Herbarium, no. 1,180,543, collected in wet forest on Barro Colorado Island in Gatún Lake, Canal Zone, Panama, June 6, 1923, by William R. Maxon (no. 6808).

The following additional collections from Barro Colorado Island belong here: *Standley* 31365, 31326, 40880, 41088, 41145.

Lycianthes Maxonii is related, apparently, to the Guatemalan *L. ceratocalycia* (Donn. Smith) Bitter, which has a calyx with usually 10 appendages, and a corolla 15 mm. long.

Lycianthes Maxonii var. **appendiculata** Standl., var. nov.

Like the typical form in habit and foliage; pedicels solitary; calyx furnished with 5 filiform divaricate teeth about 1.5 mm. long, inserted well below the truncate margin.

Type in the U. S. National Herbarium, no. 1,217,917, collected in moist forest along the Río Tapia, Province of Panama, Panama, by Paul C. Standley (no. 28040).

In the long spreading calyx appendages this plant is strikingly different from the typical form, but since there are no other distinguishing characters, it is probably only a variant of the plant found on Barro Colorado Island.

Lycianthes solitaria (Blake) Standl.

Solanum solitarium Blake, Contr. U. S. Nat. Herb. **24**: 21. 1922.

Solanum calochromum Blake, published on the same page, is a synonym of *Lycianthes nitida* Bitter, both names being based in part on the same collections.

Solanum hirsutissimum Standl., sp. nov.

Plant herbaceous or suffrutescent, sparsely branched, about 1 meter high, the branchlets stout, densely pilose with soft divaricate several-celled hairs 4–5 mm. long, densely prickly, the prickles stout, laterally compressed, divaricate or recurved, minutely glandular, 5–10 mm. long, at base 2.5–6 mm. broad; leaves solitary, the petioles 2.5–5 cm. long, pilose and prickly like the stems; leaf blades broadly ovate or rounded-elliptic, 13–19 cm. long, 9–16 cm. wide, acute or obtuse, at base truncate or subcordate, shallowly lobed, the lobes about 5 on each side, broadly triangular, acute or obtuse, up to 2.5 cm. long; leaves densely pilose on both surfaces, armed on the nerves with long straight prickles, the hairs of the upper surface long, simple, those of the lower surface sessile or short-stipitate, multiradiate at apex, the rays elongate, several-celled, simple hairs often mixed with the stellate ones; pedicels pseudolateral, solitary or geminate, slender, 1.5–2 cm. long, densely pilose, unarmed, recurved in fruit; calyx campanulate, 5-lobed to the middle, outside densely pilose with slender simple glandular hairs, 17 mm. long, about 20 mm. broad, thin, the lobes broadly ovate, obtuse or acutish; corolla 2 cm. long, densely glandular-pilose outside; stamens equal, the anthers subsessile, connivent, 11 mm. long, 2 mm. wide, dehiscent by apical pores; ovary densely hirsute; fruit globose, orange-colored, about 3 cm. in diameter, smooth, sparsely hirsute, the hairs long, bearing at the base numerous very short rays; seeds numerous, compressed, 2.5 mm. wide, scrobiculate.

Type in the U. S. National Herbarium, no. 715419, collected along the Río Dupí, eastern Chiriquí, Panama, near sea level, Dec. 19, 1911, by H. Pittier (no. 5217). The following collections also belong here:

PANAMA: Río Tapia, Province of Panama, *Standley* 30659, 28293, 26157.

This plant is weedy in habit and ordinary in appearance, and should be referable to some earlier described species, but I have been unable to find any description or named specimens with which it agrees.

Solanum allophyllum (Miers) Standl.

Pionandra allophylla Miers in Seem. Bot. Voy. Herald 174. 1854.
Cyphomandra allophylla Hemsl. Biol. Centr. Amer. Bot. **2**: 417. 1882.
Solanum ellipsoideibaccatum Bitter, Repert. Sp. Nov. Fedde **11**: 486. 1913.

The specific name is too much like *S. alloiophyllum* Dammer, but since the two are derived from different Greek words, both may be maintained in the genus.

Capsicum macrophyllum (H. B. K.) Standl.

Witheringia macrophylla H. B. K. Nov. Gen. & Sp. **3**: 14. 1818.
Bassovia macrophylla Coulter, Bot. Gaz. **16**: 145. 1891.

Parmentiera Valerii Standl., sp. nov.

Tree about 12 meters high, the trunk 40 cm. in diameter, the crown narrow, sparsely branched, the branchlets ochraceous, glabrous, furnished with numerous pale lenticels; leaves subopposite, often fascicled at the nodes, the petioles slender, glabrous, 4–7 mm. long; leaflets 4–7, usually 5, slender-petiolulate, elliptic to obovate, 2.5–5 cm. long, acute, at base attenuate or cuneate, entire, glabrous, blackish when dried; flowers and fruits borne on the lower part of the trunk, fasciculate, the pedicels 2–2.5 cm. long; calyx green, spathaceous, cleft on one side to the base, rounded at apex, glabrous, 3.2–4 cm. long; corolla white, 6–7.5 cm. long, glabrous, funnelform, the tube 6–7 mm. thick, 2–3 cm. wide in the throat, the lobes short, undulate; immature fruit about 20 cm. long and 4 cm. thick, green, smooth; seeds oval, compressed, about 6 mm. long.

Type in the U. S. National Herbarium, no. 1,251,451, collected in wet forest near Naranjos Agrios, Guanacaste, Costa Rica, altitude 700 meters, Jan. 29, 1926, by Paul C. Standley and Juvenal Valerio (no. 46411).

Only one tree of this species was seen in the Cordillera of Tilarán. This was too large to be climbed, and it was only by throwing sticks at the high crown that imperfect specimens of the leaves could be obtained. The leaves seemed very immature, and when fully grown they probably exceed considerably the dimensions indicated in the description.

The two other species of *Parmentiera* known from Central America have uniformly three leaflets and winged petioles.

ZOOLOGY.—*Rhigonema* (*Isacis* Scrjabin, 1914; *?Isacis* Baylis & Daubney, 1926; nec *Isacis* Lespés, 1856), *nemas inhabiting the intestine of millipeds.*[1] J. R. CHRISTIE and N. A. COBB, Bureau of Plant Industry.

The first rhigonema adequately described was *Ascaris infecta* Leidy, 1849, from North America,—redescribed and figured in "A Flora and Fauna within Living Animals," Smithsonian Contributions to Knowledge, Washington, 1853; a second was *Rhabditis acuminata* D'Udekem, 1859, from Europe; a third, the type species, *Rhigonema brevicolle* Cobb, 1898, from Australia; a fourth, *Isacis multipapillata* Scrjabin, 1914, from British East Africa. These rhigonemas constitute a very distinct and easily recognized homogeneous generic group.

ISACIS

The rhigonemas have been wrongly referred to *Isacis*, Lespés, 1856.[2] We consider it impossible, from the literature or in any other way, satisfactorily to determine the nema from the investigation of which Lespés proposed his insufficiently characterized genus *Isacis*, and therefore think the name *Isacis* should be abandoned. The various efforts to rehabilitate it have resulted only in additional uncertainty and confusion. Of the well founded nemic genera, established, some of them before the date of Lespés' article, some of them later, there are several to which Lespés' nema might conceivably be assigned, but always with so much uncertainty as to make such a course wholly impracticable,—e.g. *Diplogaster*, *Rhabditis*, *Anguillula*, one or more of the *Oxyuridae*, and several others. Lespés said his specimens closely resembled *Leptodera* Dujardin; were three-lipped, oviparous, and with the vulva near the middle of the body. He declared the male sexual armature identical with that of *Leptodera*, except that there was no bursa. Lespés gave no clear indication that his specimens possessed a pharynx;—we presume his word "bouche" should be translated, "mouth," and not "pharynx" or "throat." His "three tubercles" we take to be the three lips he later mentioned, faintly shown also in his illustrations. The illustrations show the presence of two equal spicula, but whether joined distally, as in some rhabdites, is left uncertain. He clearly figured the accessory piece,—

[1] Received Nov. 27, 1926.

[2] Ann. Sci. Nat. IV. Zool. 5-6: 335. 1856.

in fact, of all the characters he listed, the nature of the accessory piece was one of the most clear and unmistakable.

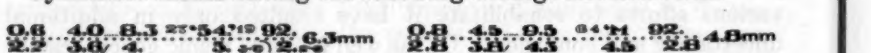
Nevertheless the characters he gave do not adequately define either a species or a genus.

ISACIS AND RHIGONEMA

While the features described by Lespés are inadequate for the characterization of either a species or a genus, they are ample, in our opinion, to exclude from *Rhigonema* any species having them. Yet Scrjabin carefully described a *Rhigonema*, his *R. multipapillata*, and referred it to *Isacis* Lespés; (perhaps following Diesing,—a course we are unable to understand, for it is very manifest that Diesing's "*Isacis* Lespés" designates a practically meaningless collection of either unrecognizable or incompatible forms). The same course has been followed by Baylis and Daubney, whose text seems to indicate that they used Scrjabin's description as a main source for the characterization of *their Isacis* Lespés.

RHIGONEMA, COBB, 1898.

Cylindroid nemas having the following average size and form:—



with a more or less acute conoid posterior extremity; cuticle colorless, exceedingly finely striated, faintly winged if at all, sometimes with exceedingly minute retrorse prickles, especially anteriorly; lateral chords one-sixth to one-third as wide as the body; musculature oxyuroid,—e.g. in *R. infectum*, 16 equivalent fields, 4 in each quadrant; anteriorly subtruncate with three very flat, thin, mobile lips overlying an exceedingly shallow vestibule, leading to a small but definite triquetrous pharynx, this latter armed in front with three broad, inwardly arcuate, lobed and denticulate, more or less retrorse onchia joined into a transverse triangle, at the blunt corners of which they are so "hinged" together as to be worked by antagonistic muscles: (1) very weak "extensors" passing from the onchia radially outward and very slightly forward, the muscles doubtless aided by the elasticity of the labial region; (2) powerful retractors passing from the onchia backward and outward. Cephalic papillae, four, submedian, small;

circular depressed amphidial openings small, but larger than the papillae, and arranged in practically the same circlet with them near the margin of the head. Oesophagus unusually broad and strong, with a more or less indistinct pharyngeal swelling but very distinct, broad, even napiform, highly muscular cardiac bulb, set off, fore and aft, by distinct constrictions and armed with a large triple corrugated valve. A circlet of nine (3 double; also 3 single, opposite the onchia and alternating with the 3 double) saccate, cephalic, often pigmented glands empty into the pharynx. Large cardia flat, three-lipped. The faintly tessellated intestine is set off by a distinct constriction. Renette bilateral. Anterior lip of the vulva usually more or less papilliform and slightly retrorse. '♀', the details as figured by Leidy, except that the pear-shaped swelling between each ovary and uterus should be regarded as a spermatheca. In young but mature females elongated cephalated sperms may occur in the unpaired enlargement sometimes present near the vulva. The numerous ellipsoidal, smooth eggs are deposited after segmentation has begun. Males with two equal spicula without accessory piece. '♂. No bursa. There is a single pre-anal ventral papilla in addition to the small pre- and post-anal "submedian" ones. Type species, *R. brevicolle*.

Habitat: Parasitic in the intestine of millipeds.

Julus and *Spirobolus*, both hosts of rhigonemas, represent groups of millipeds consisting of numerous species found in many different parts of the world. This fact, together with the morphology and distribution of the known rhigonemas, warrants the prediction that species of *Rhigonema* will prove numerous. Parona's *Isacis modiglianii*, 1896, may perhaps prove to be a rhigonema.

As the millipeds have come down to us from as long ago as the carboniferous era with relatively little morphological, and therefore presumably little physiological, change, their parasites are of unusual interest. Should the latter also have meanwhile evolved similarly, it is not unreasonable to expect from this source hints as to the primitive form of some nemic structures.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

940TH MEETING

The 940th meeting was held in the auditorium of the Cosmos Club on Saturday evening, May 15, 1926. The meeting was called to order by President BOWIE at 8:17, with 55 persons in attendance.

The program for the evening consisted of an address by Dr. JOHN C. MERRIAN on *The Meaning of Evolution in Individnal Experience.* Discussed by Messrs. HAWKESWORTH, C. A. BRIGGS, CRITTENDEN, WRIGHT, BOWIE, TUCKERMAN, MARMER, THONE and others.

941ST MEETING

The 941st meeting was held jointly with the Washington Academy of Sciences and the Chemical Society on Saturday evening, May 29, 1926, in the Auditorium of the Cosmos Club. The meeting was called to order by President BURGESS of the Academy at 8:16 P.M. with 144 persons in attendance.

The program for the evening consisted of an address by Professor ERNST COHEN of the University of Utrecht, on the subject: *Metamorphosis of matter and the alleged constancy of our physico-chemical constants.* The address was illustrated with lantern slides and with experiments. Discussed by Messrs. WASHBURN, NORRIS, HUDSON, HEYL, SOSMAN, LIND, WRIGHT, and WHITE.

942D MEETING

The 942d meeting, the first meeting following the summer intermission, was held at the Cosmos Club on Saturday evening, October 2, 1926. The meeting was called to order by President BOWIE at 8:16 P.M. with 52 persons in attendance.

The program for the evening consisted of an address by Dr. H. U. SVERDRUP Director of the Geophysical Institute B of Bergen, on *The tides on the north Siberian shelf; their bearing on the existence of land in the Arctic Sea, and their dynamics* (Illustrated with lantern slides).

The address was published in THIS JOURNAL for Dec. 3, 1926.

The subject was discussed by Messrs. BREIT and MARMER. On behalf of the Society President BOWIE thanked the speaker for his interesting address.

Upon call for informal communications Mr. W. D. LAMBERT called attention to the work of Esclangon on the hypothesis of a cosmic tide due to the translation of the solar system through space. This was discussed by Messrs. BREIT and WOOLARD. Mr. HAWKESWORTH then spoke on a mathematical development of the law of disintegration of radium.

943D MEETING

The 943d meeting was held at the Cosmos Club on Saturday evening, October 16, 1926. The meeting was called to order by Vice-President AULT at 8:17 P.M. with 65 persons in attendance.

The program for the evening consisted of an address by Dr. C. G. ABBOT, on *A new observatory in Southwest Africa.* (Illustrated with lantern slides.) The speaker described the present state of the investigation of the Smithsonian Institution on the variation of the sun. For fifteen years, measure-

ments were carried on by the method of Langley at Mount Wilson, California, from 1905 to 1920. Beginning with July, 1918, daily observations, as far as possible, have been continued at Calama, Chile, and at Mount Montezuma, Chile, up to the present time. Starting with October, 1920, observations were continued at Mount Harqua Hala, Arizona, until October, 1925, when the station was removed to Table Mountain, California, where the daily observations are still going on.

A comparison of the daily values at Mount Montezuma and Mount Harqua Hala indicates an average daily divergence of about ½ per cent. A considerable number of days failed of observations at both stations, and a large number failed of record at one station or the other. Hence it appeared that the satisfactory study of the variation of the sun requires at least one, and preferably two additional stations, to be located in the most cloudless and favorable high-altitude regions to be found in the world.

The National Geographic Society, appreciating this need, and the world-wide bearing of the observations of the sun's radiation, made a grant to Dr. ABBOT in the year 1925 to enable him to select the best available station in the eastern hemisphere, equip an observatory, and carry it on for approximately four years.

The speaker described the conditions desirable and the evidence which pointed to Algeria, Baluchistan and Southwest Africa as the most promising countries for the location. He described the investigations which were made in these countries, which resulted in the selection of Mount Brukkaros in Southwest Africa of which the altitude is 5,202 feet, the longitude, 17° 48′ E and the latitude 25° 52′ S. As this station is situated in the central part of the Hottentot Reservation it was necessary to obtain permission of the Hottentots to locate there. The road, garage, reservoirs, observing tunnels and dwelling house were prepared during the summer of 1926, under the direction of Mr. A. Dryden, Inspector of Public Works for the Government of Southwest Africa.

An expedition under Mr. W. H. Hoover, field director, with Mr. F. A. Greeley, assistant, provided with sixty cases of apparatus and accessories, landed at Cape Town on September 13, 1926, and it was expected that actual observations on Mount Brukkaros would be undertaken by the end of October.

The average rainfall in the region is 3½ inches. It occurs mainly in the months of February and March, so that the months of December and January which are the least satisfactory at the stations on Table Mountain and Montezuma will be very good months at Mount Brukkaros. The speaker was at or near Mount Brukkaros for twelve days in early March, which is the height of the rainy season, and during his stay eleven days of the twelve would have been satisfactory for the solar radiation observations.

Doubt having been expressed by various critics as to the reality of the variation of the sun, and as to the reality of the influence which, according to Clayton, solar variation reflects on the weather, the speaker exhibited a number of slides confirming these supposed effects. Numerous slides illustrative of the journey of explorations and the stations engaged in solar radiation work were shown. (*Author's abstract.*)

The address was discussed by Dr. BREIT.

944TH MEETING

The 944th meeting was held at the Cosmos Club on Saturday evening, October 30, 1926. The meeting was called to order by President BOWIE at 8:17 with 36 persons in attendance.

The program for the evening consisted of two papers. The first by W. P. WHITE was on *Improvements in galvanometer stabilizers.* Apparatus, particularly galvanometers, can be shielded from horizontal disturbances by hanging with wires or cords. Julius (1895), who used three wires, showed that the suspended body is apt to perform vibrations about a horizontal axis through its own center of gravity. He tried to avoid these by attaching his wires at the same level as the center of gravity and subsequently arranged to place the galvanometer so that its head came at the point of least motion, that is, at the center of gravity. This produced a relatively complicated and expensive apparatus. He put his dampers also at the level of the center of gravity. These dampers were crossed vanes of sheet metal attached to the stabilizer and immersed in pots of heavy oil.

In some cases it has been found that these secondary rotational oscillations are negligible. When this is the case the construction can be much simplified. A suggestion coming from the Reichsanstalt is that the damper should be put below. This is both easier and more convenient and tends to damp the secondary oscillations, which Julius' arrangement damps as little as possible.

With swing coil galvanometers exceedingly slight changes of level produce large deflections, and it seems probable that an instrument suspended from three long, slender wires would be tipped through differential expansion if the room temperature is not especially uniform and constant. This difficulty is almost entirely avoided if the instrument is suspended from two wires which hang from two opposite arms of a horizontal cross whose two other arms are supported from above and which is free to shift its position slightly in case the wires expand differently.

Heavy oil is an admirable damper. An instrument floating in the center of a moderately large tank of it—one containing perhaps from twenty to forty dollars worth of oil—would probably be stabilized for almost any conceivable conditions. Damping is almost indispensable with suspended bodies (oil damping is generally used), but the damper transmits some motions while it quenches others. If the vessel of oil is relatively wide impulses coming from its walls, that is, from the building, are largely damped by the oil itself before they reach the suspended apparatus. Damping alone, however, will not insure complete absence of vibration because the damper has no action until some motion is present.

Since the vibrations of apparatus, especially of suspended apparatus, are largely influenced by resonance, general conclusions can not be drawn from the performance in a few instances. (*Author's abstract.*)

The paper was discussed by Messrs. BOWIE, MCKEEHAN, TUCKERMAN and HUMPHREYS.

The second paper of the program was by G. R. WAIT on *The magnetic permeability of iron and magnetite in high-frequency alternating fields.* (Illustrated with lantern slides). Arkadiew measured the absorption of electric waves by two parallel wires, and found that the permeability of iron and nickel wires varied with the wave-length. The values for both iron and nickel decreased to very small values when the wave-length was decreased to 1.3 cm. He explained this decrease in the ferro-magnetic property in iron and nickel on the basis of the natural vibrations of the elementary magnets. From these results, together with those of other workers, particularly those of Kartschagin and those of Wwedensky and Theodortschik, the conclusion was drawn that the elementary magnets had several periods of oscillation. In

view of the attention this subject has received and must continue to receive in the field of magnetism, the author undertook a repetition of the work of Wwedensky and Theodortschik.

Two experimental methods have been followed, the one making use of a high-frequency oscillating tube circuit and a resonating circuit, the other employing two high-frequency tube circuits and one audio-frequency circuit. The former is known as the resonance method and the other as the heterodyne beat method.

Various forms of iron, such as filings, wires, and powder, were used as well as magnetite in the form of crystals and powder. The resonance method extended from about 50 to 160 meters wave-length, while the heterodyne beat method covered the range from about 80 to 1,700 meters.

Wwedensky and Theodortschik found an abnormal increase in the permeability of iron wires at about 100 meters which was attributed by them to the resonance of the elementary magnets. The present investigation failed to confirm this result. Although apparent anomalies at first were found, it was discovered that they were all due to resonance between various parts of the circuit. Upon eliminating this difficulty no abnormal change in permeability over the range covered was found. Consequently, the author feels justified in concluding that if elementary oscillators exist, they have failed to resonate at the frequencies employed.

Various errors in the work of Wwedensky and Theodortschik were pointed out. Some of these may have been largely responsible in producing the apparent anomalies observed by them. (*Author's abstract.*)

The subject was discussed by Messrs. BAUER, MCKEEHAN, SOSMAN and BREIT. The complete paper will be published in an early number of the *Physical Review*.

Upon invitation of the President, Dr. BAUER explained informally the status of the International Research Council and affiliated Unions.

H. A. MARMER, *Recording Secretary.*

GEOLOGICAL SOCIETY

406TH MEETING

The 406th meeting was held in the Cosmos Club May 6, 1925.

Program: T. A. JAGGER: *Engulfment in volcanism.* The speaker called attention to the published result of measurement of volume of rock engulfed[1] in the explosive eruptions at Kilauea in May, 1924. Engulfment accounted for 253 times the amount ejected explosively. This observation was made by Mr. R. H. Finch at the Observatory. The engulfed rim rock equalled over seven billion cubic feet, equivalent to a cylindrical column reaching down 3,000 feet below the bottom of the remnant pit, and having the diameter of that bottom. This breccia must partially choke the vent to great depths. The explosions appeared to be actuated by steam, rising through orifices in the jumble of fallen crags, ejecting nothing but old and mostly crystalline rocks, and vented by different parts of the bottom area. The explosion phenomena followed three months of down-faulting and crateral subsidence, and accompanied acceleration of engulfment already initiated. Engulfment phenomena in great volume have been common in the past without any explosion. The sequence of phenomena from 1914 to 1924 agrees with the hypoth-

[1] Bull. Haw. Volc. Obs., December, 1924.

esis that tension of magma opened fault rifts in the larger edifice, lava in the pit shaft lowered hydrostatically, the pit walls collapsed into the rift when deprived of the magmatic pressure, ground water entered the shaft between hot lava below and a plugged vent above, and a geyser mechanism resulted. Thereafter the gas tension in the magma reasserted itself, the lava rose and shut off the ground water, and in July the lava reappeared for a fortnight in the bottom of the pit.

Dr. E. S. SHEPHERD suggests that the enormous amount of weathered rock engulfed would feed oxygen in the form of ferric iron oxide to new attack by hydrogen, so that a large amount of heat would be liberated, and the ferric iron would be reduced to ferrous. The abundant surfaces of the breccia would make diffusion possible in a rising magma charged with hydrogen, resulting in oxidation of the hydrogen thoroughly but not too rapidly, and in oxidized gas at the surface of the lava lakes. This is what we find. An excess of ferric over ferrous oxide in the engulfed material of only one percent more than in the glass would raise the temperature of one tenth of the breccia from 20°C. to 1200°C. yielding heat enough to keep the volcano going for years. (*Author's Abstract.*)

J. D. SEARS, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

The Smithsonian Institution has received recently the botanical library which was presented to the Institution several years ago by Captain John Donnell Smith, of Baltimore. This is one of the finest private botanical libraries of the United States, and is especially rich in works relating to the flora of tropical America.

Mr. ELLSWORTH P. KILLIP and Mr. ALBERT C. SMITH, of the National Museum, who are engaged in botanical exploration in Colombia, have had headquarters for several weeks at Cartagena. This port is of interest because it is the type locality of many species described by Jacquin over 150 years ago. A visit has been made also to Turbaco, where Humboldt collected the types of many plant species.